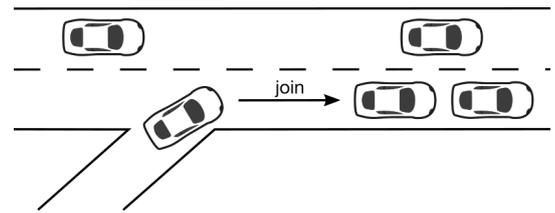**Bachelor/Master's Thesis**

Wireless Channel Feedback for Platooning

Abstract

The ongoing growth of passenger transport results in more road traffic and, therefore, more traffic jams and pollution. Researchers and car manufacturers are trying to improve driving, using inter-vehicle communication, resulting in trends like intelligent transportation systems or cooperative driving. One promising development in this field is *platooning* (i.e., cooperative adaptive cruise control), which aims to improve today's driving for example on freeways.

In order to maintain a string-stable platoon, every vehicles needs to receive periodic updates (so called beacons) from the leader and its predecessor in the platoon. Depending on the concrete parameterization, this beaconing introduces a lot of load to the wireless channel, which could lead to packet collisions impacting vehicles from the same platoon or from others. The beacon rate could typically be determined by the leader of the platoon, which continuously measures the quality of the wireless channel it is experiencing. Since every vehicles experiences a different channel quality, the measurement from the leader may not correspond to measurement from e.g., the last vehicle in a platoon, which could lead to lost updates. On the other hand, if every update is perfectly received, the leader might

Platoon Joining (sample image)

be able to reduce the update rate or adjust the transmission parameters of the beacons (e.g., decrease the transmit power) to reduce the overall load on the wireless channel [1].

Therefore, every vehicle in the platoon should continuously monitor the wireless channel as well and give feedback to the leader (and its preceding vehicle) about the quality it is currently measuring. Thus, the transmission parameters (and the update rate) for beacons can be adjust accordingly.

Content

The goal of this thesis is to design a protocol that gives feedback about the wireless channel to the leader (and the previous vehicle) by continuously measuring the current channel quality. Based on this feedback, the transmission parameters (and the update rate) for beacons should be adjusted to reduce the overall channel load while still maintaining a safe and string-stable platoon [2].

After designing the protocol, it should to be implemented within Plexe[1] to analyze its performance. You should consider metrics for networking (e.g., channel load) as well as safety (e.g., minimum gap to the front vehicle).

Requirements

You should have a basic understanding of *Vehicular Networking*, *Network Simulation*, and *C++*.

[1]   C. Sommer, O. K. Tonguz, and F. Dressler, "Adaptive Beaconing for Delay-Sensitive and Congestion-Aware Traffic Information Systems," in *2nd IEEE vehicular networking conference (VNC 2010)*, 2010, pp. 1–8, doi: 10.1109/VNC.2010.5698242.

[2]   M. Segata, "Safe and Efficient Communication Protocols for Platooning Control," PhD Thesis, University of Innsbruck; Institute of Computer Science, Innsbruck, Austria, 2016.

[1] http://plexe.car2x.org/